UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
PO Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/910,824	07/24/2001	Hiroshi Tobimatsu	50090-306	3928

7590 06/18/2003

McDermott, Will & Emery
600 13th Street, N.W.
Washington, DC 20005-3096

EXAMINER
LEE, HSIEN MING

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/910,824	TOBIMATSU ET AL.	
	Examiner	Art Unit	
	Hsien-Ming Lee	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133)
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Remarks

1. Applicants' cancellation to claim 5 is acknowledged. Claims 1-4 and 6 are pending in the application.

2. The 112-second-paragraph rejection to claim 1 is withdrawn in response to applicants' amendment filed 4/8/03.

Claim Objections

3. Claim 1 is objected to because of the following informalities: editorial error at line 13, wherein " to remove O.1 to several micrometers" should be -- to remove **0.1 μm** to several micrometers --. (Emphasis added) Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinohara (US 6,127,099) in view of Sakurai (US 6,287,750) and Fu et al. (US 5,807,787).

In re claims 1-4 and 6, Shinohara teaches the claimed method of manufacturing a semiconductor device (Figs. 2A-2G and related text) comprising the steps of :

- forming an interconnection 14 on a semiconductor substrate 11/12 having a semiconductor element such as a wiring element (not shown) formed thereon;

- forming a passivation film 15 (Si_3N_4) on the semiconductor substrate 11/12 including the interconnection 14 (Fig.2C);
- forming a photosensitive polyimide film 16 by spin-on-coating a polyimide precursor (col.3, lines 9-10), which is served as a buffer coating film, on the passivation film 15 (Fig.2D);
- patterning the photosensitive polyimide film 16 (Fig. 2E);
- etching the passivation film 15 while the patterned photosensitive polyimide film 16 is taken as a mask , i.e. exposing the interconnection 14 by etching the passivation film 15 using CF_4-O_2 gas mixture or similar fluorine-based gas mixture (Fig.2F and col. 3, lines 17-20);
- ashing the surface of the substrate 11/12 by an **oxygen plasma**, inherently including ashing the surface of the polyimide film 16 (col. 3, lines 20-44); and
- curing the semiconductor substrate 11/12 by subjecting the substrate 11/12 to a heat treatment at a temperature of between 300 C and 400 C for a time of 60 minutes to 120 minutes to convert the polyimide film 16 into imide (col.3, lines 23-25 and 38-40).

Shinohara is silent as to the formation of a hardened layer on the surface of the photosensitive polyimide film 16 resulting from the etching step.

However, Sakurai, in an analogous art, teach etching the passivation film 203 (silicon nitride, which is same material as that of Shinohara), while the patterned photoresist layer 205 is taken as a mask, by using same etchant as that of Shinohara (i.e. fluoric system) to expose the

interconnection 202 (col.2, lines 24-25 and 41-44). As a result, a hardened layer is formed on the surface of the photoresist layer 205 (col. 2, lines 41-44).

Therefore, in light of teachings of Sakurai, it would have been obvious to one of the ordinary skilled in the art, at the time the invention was made, to recognize that the hardened layer is consequently formed on the surface of the polyimide film 16 of Shinohara because both Shinohara and Sakurai use same etchant (i.e. fluorine-based enchant) to etch same material (i.e. silicon nitride) via a similar mask (the polyimide mask 16 of Shinohara versus the photosensitive photoresist mask 205 of Sakurai).

Still, Sakurai does not expressly teach that the photoresist mask 205 is the photosensitive polyimide.

However, Fu et al., in an analogous art, teach utilizing the photosensitive polyimide as the photoresist mask 14 to etch a passivation film 12 for exposing an interconnection 4 (Fig.2 and col. 5, lines 37-40).

Therefore, one of the ordinary skilled in the art would have been motivated to utilize the polyimide, as taught by Fu et al., as the material for the photoresist mask of Sakurai, which is equivalent to the polyimide film 16 of Shinohara, since by this manner the hardened layer is formed on the surface of the polyimide film of Shinohara. In other words, in light of Sakurai and Fu et al., the formation of the hardened layer on the surface of the polyimide mask of Shinohara is a **natural consequence under the same etching conditions** although Shinohara is silent about the hardened layer.

Since Shinohara in view of Sakurai and Fu et al. teach the formation of the hardened layer on the surface of the polyimide layer and ashing the polyimide layer by the oxygen plasma

(col. 3, lines 20-44, Shinohara), the combined teachings also teach the claimed step of ashing to remove the hardened layer formed on the surface of the polyimide film as a result of the etching.

Still, Shinohara in view of Sakurai and Fu et al. do not teach ashing to remove 0.1 micrometer to several micrometers of the polyimide film in the ashing step. However, the selection of removed thickness is obvious to the ordinary skilled in the art because it is a matter of determining optimum process condition by routine experimentation. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

In this case, it would have been obvious to the ordinary skilled to remove a desired thickness from the polyimide film during the ashing process to eliminate the hardened layer on the surface of the polyimide film since the hardened layer is an **undesirable residue resulting from the etching processing and is harmful to the device**. One of the ordinary skilled would have been motivated to remove the entire thickness of the hardened layer, regardless the thickness. In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results. See M.P.E.P. 2144.05 III.

Response to Arguments

6. Applicant's arguments filed 4/8/03 have been fully considered but they are not persuasive for the reasons as follow.

Applicants argue that Shinohara fails to teach utilizing oxygen ashing technique to remove a hardened layer from the surface of the polyimide film because Shinohara does not

teach conditions for employing oxygen ashing and thickness range removing from the surface of the polyimide (page 4, second paragraph).

In response to the arguments, it is submitted that Shinohara does teach **utilizing the oxygen ashing** (i.e. oxygen plasma, abstract, lines 5-7 and col. 3, lines 32-37) **under conditions of ashing** the substrate including the surface of the polyimide film, as stated in paragraph 5 of the Office action. As far as the removed thickness from the surface of the polyimide film is concerned, it is obvious to be the routine experimentation, as stated above. In addition, the originally specification fails to demonstrate the criticality of the removed thickness.

Applicants also argue that Sakurai does not disclose using a photoresist polyimide film. (third paragraph, page 4). To remedy the deficiency of Sakurai, Fu's teachings is cited, wherein Fu et al. disclose using polyimide film as the photoresist film. The motivation for the combination is clearly stated above.

Applicants further argue that Fu et al. do not disclose or suggest the formation of a hardened film on the photoresist polyimide film. (fourth paragraph, page 4).

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

For the aforementioned reasons, the 103(a) rejections to claims 1-4 and 6 are deemed proper.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Hsien-Ming Lee
Examiner
Art Unit 2823

June 13, 2003

W. David Coleman
Primary Examiner
Tech Center 2800